



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 20, 2014

Vice President, Operations
Entergy Operations, Inc.
River Bend Station
5485 U.S. Highway 61N
St. Francisville, LA 70775

SUBJECT: RIVER BEND STATION, UNIT 1 – STAFF ASSESSMENT OF THE FLOODING WALKDOWN REPORT SUPPORTING IMPLEMENTATION OF NEAR-TERM TASK FORCE RECOMMENDATION 2.3 RELATED TO THE FUKUSHIMA DAI-ICHI NUCLEAR POWER PLANT ACCIDENT (TAC NO. MF0272)

Dear Sir or Madam:

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued a request for information letter per Title 10 of the *Code of Federal Regulations*, Section 50.54(f) (50.54(f) letter). The 50.54(f) letter was issued to power reactor licensees and holders of construction permits requesting addressees to provide further information to support the NRC staff's evaluation of regulatory actions that may be taken in response to lessons learned from Japan's March 11, 2011, Great Tōhoku Earthquake, resultant tsunami, and subsequent accident at the Fukushima Dai-ichi nuclear power plant. The request addressed the methods and procedures for nuclear power plant licensees to conduct flooding hazard walkdowns to identify and address degraded, nonconforming, or unanalyzed conditions through the corrective action program, and to verify the adequacy of the monitoring and maintenance procedures.

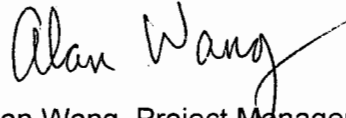
By letter dated November 27, 2012, Entergy Operations, Inc. (Entergy), submitted a Flooding Walkdown Report as requested in Enclosure 4 of the 50.54(f) letter for the River Bend Station, Unit 1. By letter dated January 27, 2014, Entergy provided a response to the NRC staff's request for additional information dated December 23, 2013, for the NRC staff to complete its assessments.

The NRC staff has reviewed the information provided and, as documented in the enclosed staff assessment, has determined sufficient information was provided to be responsive to Enclosure 4 of the 50.54(f) letter.

- 2 -

If you have any questions, please contact me at (301) 415-1445 or by e-mail at Alan.Wang@nrc.gov.

Sincerely,

A handwritten signature in black ink that reads "Alan Wang". The signature is written in a cursive style with a long horizontal stroke extending to the right.

Alan Wang, Project Manager
Plant Licensing IV-2 and Decommissioning
Transition Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-458

Enclosure:
Staff Assessment of Flooding
Walkdown Report

cc w/encl: Distribution via Listserv

STAFF ASSESSMENT OF FLOODING WALKDOWN REPORT
NEAR-TERM TASK FORCE RECOMMENDATION 2.3 RELATED TO
THE FUKUSHIMA DAI-ICHI NUCLEAR POWER PLANT ACCIDENT
ENERGY OPERATIONS, INC.
RIVER BEND STATION, UNIT 1
DOCKET NO. 50-458

1.0 INTRODUCTION

On March 12, 2012,¹ the U.S. Nuclear Regulatory Commission (NRC) issued a request for information per Title 10 of the *Code of Federal Regulations*, Section 50.54(f) (50.54(f) letter) to all power reactor licensees and holders of construction permits in active or deferred status. The request was part of the implementation of lessons learned from the accident at the Fukushima Dai-ichi nuclear power plant. Enclosure 4, "Recommendation 2.3: Flooding,"² to the 50.54(f) letter requested licensees to conduct flooding walkdowns to identify and address degraded, nonconforming, or unanalyzed conditions using the corrective action program (CAP), verify the adequacy of monitoring and maintenance procedures, and report the results to the NRC.

Enclosure 4 of the 50.54(f) letter requested licensees to include the following:

- a. Describe the design basis flood hazard level(s) for all flood-causing mechanisms, including groundwater ingress.
- b. Describe protection and migration features that are considered in the licensing basis evaluation to protect against external ingress of water into SSCs [structures, systems, and components] important to safety.
- c. Describe any warning systems to detect the presence of water in rooms important to safety.
- d. Discuss the effectiveness of flood protection systems and exterior, incorporated, and temporary flood barriers. Discuss how these systems and barriers were evaluated using the acceptance criteria developed as part of Requested Information item 1.h.
- e. Present information related to the implementation of the walkdown process (e.g., details of selection of the walkdown team and procedures,) using the documentation template discussed in Requested Information item 1.j, including actions taken in response to the peer review.

¹ Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340.

² ADAMS Accession No. ML12056A050.

- f. Results of the walkdown including key findings and identified degraded, nonconforming, or unanalyzed conditions. Include a detailed description of the actions taken or planned to address these conditions using guidance in Regulatory Issues Summary 2005-20, Revision 1, Revision to the NRC Inspection Manual Part 9900 Technical Guidance, "Operability Conditions Adverse to Quality or Safety," including entering the condition in the corrective action program.
- g. Document any cliff-edge effects identified and the associated basis. Indicate those that were entered into the corrective action program. Also include a detailed description of the actions taken or planned to address these effects.
- h. Describe any other planned or newly installed flood protection systems or flood mitigation measures including flood barriers that further enhance the flood protection. Identify results and any subsequent actions taken in response to the peer review.

In accordance with the 50.54(f) letter, Enclosure 4, Required Response Item 2, licensees were required to submit a response within 180 days of the NRC's endorsement of the flooding walkdown guidance. By letter dated May 21, 2012,³ the Nuclear Energy Institute (NEI) staff submitted NEI 12-07, Revision 0-A, "Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features," to the NRC staff to consider for endorsement. By letter dated May 31, 2012,⁴ the NRC staff endorsed the walkdown guidance.

By letter dated November 27, 2012,⁵ and as documented in its Walkdown Report⁶ Entergy Operations, Inc. (Entergy, or the licensee), provided a response to Enclosure 4 of the 50.54(f) letter Required Response Item 2, for the River Bend Station, Unit 1 (RBS) site. The NRC staff issued a request for additional information (RAI) to the licensee regarding the available physical margin (APM) dated December 23, 2013.⁷ The licensee responded by letter dated January 27, 2014.⁸

The NRC staff evaluated the licensee's submittals to determine if the information provided in the walkdown report met the intent of the walkdown guidance and if the licensee responded appropriately to Enclosure 4 of the 50.54(f) letter.

2.0 REGULATORY EVALUATION

The SSCs important to safety in operating nuclear power plants are designed either in accordance with, or meet the intent of Appendix A to 10 CFR Part 50, "General Design Criteria

³ ADAMS Package Accession No. ML121440522.

⁴ ADAMS Accession No. ML12144A142.

⁵ ADAMS Accession No. ML12340A071.

⁶ ADAMS Accession No. ML12340A072.

⁷ ADAMS Accession No. ML13325A891.

⁸ ADAMS Accession No. ML14042A161.

for Nuclear Power Plants,” Criterion 2, “Design bases for protection against natural phenomena,” and Appendix A “Seismic and Geological Criteria for Nuclear Plants,” to 10 CFR Part 100. Criterion 2 states that SSCs important to safety at nuclear power plants shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions.

For initial licensing, each licensee was required to develop and maintain design bases that, as defined by 10 CFR 50.2, identify the specific functions to be performed by an SSC, and the specific values or ranges of values chosen for controlling parameters as reference bounds for the design.

The design bases for the SSCs reflect appropriate consideration of the most severe natural phenomena that have been historically reported for the site and surrounding area. The design bases also reflect sufficient margin to account for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.

The current licensing basis (CLB), as defined in 10 CFR 54.3(a), is the set of NRC requirements applicable to a specific plant, and a licensee’s written commitments for ensuring compliance with, and operation within, applicable NRC requirements and the plant-specific design basis that are in effect.

3.0 TECHNICAL EVALUATION

3.1 Design Basis Flooding Hazard for the River Bend Station

The licensee reported (at page 6) that the design basis flood hazard for the RBS site is a probable maximum precipitation (PMP) event. The grade elevation for the power block and other safety-related SSCs is 98 feet (ft) above mean sea level (MSL); the elevation associated with the PMP event is estimated to be 96 ft MSL.

The licensee notes that the RBS site is not considered to be susceptible to flooding by rivers, dam failures, ice flooding, or channel migration. The site is also not adjacent to any coastal area and, therefore, not vulnerable to flooding by tsunami, tidal surge, or seiche.

The site is underlain by a perched aquifer; the typical depth of the aquifer is reported by the licensee to be 57 ft MSL. During the PMP event, the water table is expected to rise to an elevation of 70 ft MSL. Consequently, the licensee reported that there is no permanent plant dewatering system at the RBS site.

Based on the NRC staff’s review, the licensee appears to have described the design basis flood hazard level(s) as in the 50.54(f) letter and consistent with the walkdown guidance.

3.2 Flood Protection and Mitigation

3.2.1 Flood Protection and Mitigation Description

The RBS is located on the eastern shore alluvial floodplain of the Mississippi River; the elevation of the river and floodplain terrace are, respectively, 20.4 ft and 35 ft MSL. The licensee reported that plant structures are situated on a second (higher) terrace rising from the floodplain whose nominal elevation is 95 ft MSL. The maximum flood water elevation estimated by the licensee is 96 ft MSL.

The licensee reports that the site's drainage characteristics are generally down-grade and away from the plant site. A site storm drainage system has also been installed to divert surface runoff away from plant buildings. That drainage system is comprised of catchment basins, artificial contour grading, drainage ditches, and storm drain pipes. Collectively, this man-made system passively conveys surface flow that might occur away from site structures to existing natural water courses that ultimately feed into the East and/or West Creeks located adjacent to the site.

3.2.2 Incorporated and Exterior Barriers

In general, the CLB flood protection measures intended to protect safety-related systems and equipment are passive features that were incorporated into the original RBS site design. The Near-Term Task Force Recommendation 2.3 (NTTF 2.3) Walkdown Report (at page 11) notes that these features rely primarily on the method of construction. All safety-related equipment has been housed in seismic Category I structures. The licensee reported that there is waterproofing of foundations and exterior walls of Seismic Category I structures below grade by using principally synthetic rubber waterstops at expansion and construction joints. All safety-related equipment is reported to have been housed in watertight cubicles. The licensee reported that access openings to the structures housing safety-related components are either located above the PMP flood elevation or are required to be closed to prevent any adverse effect from flooding of the structures. If local seepage occurs through the walls, the licensee reported that it is controlled by sumps and sump pumps. The operation of the plant, therefore, is not affected by flood conditions. Lastly, all safety-related equipment has been built above the elevation of the estimated maximum flood level for the site.

The licensee reported that no safety-related systems or equipment are affected by flooding.

The site has incorporated and/or exterior barriers that are permanently in-place, generally requiring no operator manual actions. For example, even though not credited in the CLB, the licensee reported that the Auxiliary Building, Control Building, Diesel Generator Building, Fuel Building and safety-related tunnels are all equipped with floor drainage systems. Incidental water entering these structures would flow across sloped floors, drainage conduits, or open culverts and enter the floor drainage systems to be collected in sumps at the bottom floor elevations. However, the licensee notes that no credit is taken in the CLB for the lowering of water levels by the operation of the floor drainage system. The floor drainage system would control the incidental effect of water seepage into the buildings at RBS.

3.2.3 Temporary Barriers and Other Manual Actions

The licensee did not identify any temporary barriers and other manual actions that require operator action in the event of a flood threat in the walkdown report.

3.2.4 Reasonable Simulation and Results

The purpose of performing reasonable simulations is to verify that the required flood protection procedures or activities can be executed as specified/as written. The licensee noted that flood protection features at the RBS site do not include any temporary or active features that would require the implementation of a procedure for the performance of those manual/operator actions necessary for the flood protection feature in question to perform its intended flood protection function. Hence, no "Reasonable Simulation" of manual actions was reported by the licensee to have been performed.

However, the licensee did report that under its Abnormal Operating Procedures (AOPs), there is an action to verify that the G-Tunnel west wall doors (i.e., those doors leading out to the Unit 2 Excavation areas) are closed during a severe weather event such as hurricanes, tornadoes and severe thunderstorms. The actions specified in the AOP are not credited in the CLB and failure to complete the actions would not prevent safe shutdown of the plant.

3.2.5 Conclusion

Based on the NRC staff's review, the licensee appears to have described protection and mitigation features as requested in the 50.54(f) letter and consistent with the walkdown guidance.

3.3 Warning Systems

There are no credited external flooding warning systems installed at the RBS site.

Based on the NRC staff's review, the licensee appears to have provided information to describe any warning systems as requested in the 50.54(f) letter and consistent with the walkdown guidance.

3.4 Effectiveness of Flood Protection Features

The design basis flood event at the RBS site is a PMP event. All other relevant flood mechanisms evaluated for the RBS site, including Mississippi River flooding, as well as potential dam failures and the floods caused by local streams, produce potential flood levels below the design basis PMP event.

The licensee defined the acceptance criteria for the flood protection features by the requirements in the CLB using guidance from NEI 12-07. The licensee visually inspected the flood protection features to identify any material degradation, as well as verifying the configuration with design documents.

All flood protection features at the RBS site are intended to protect safety-related equipment structures, and components against external sources of flooding. These features include reliance on the existing topography, grading of the existing ground surface, hardened reinforced concrete building design, designated waterproof rooms, and a drainage/sump collection system.

Based on the NRC staff's review, the licensee appears to have discussed the effectiveness of flood protection features as requested in the 50.54(f) letter and consistent with the walkdown guidance.

3.5 Walkdown Methodology

By letter dated June 8, 2012,⁹ the licensee responded to the 50.54(f) letter that they intended to utilize the NRC-endorsed walkdown guidelines contained in NEI 12-07, "Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features."¹⁰ The licensee's walkdown submittal dated November 27, 2012, indicated that the licensee implemented the walkdowns in accordance with the guidance provided in NEI 12-07. The licensee did not identify any exceptions from NEI 12-07.

Based on the NRC staff's review the licensee appears to have presented information related to the implementation of the walkdown process as requested in the 50.54(f) letter and consistent with the walkdown guidance.

3.6 Walkdown Results

3.6.1 Walkdown Scope

The licensee performed walkdowns of CLB flood protection features at the RBS site. For the RBS site, the number of as-built features visually inspected was approximately 36 (corresponding to 214 attributes). The walkdown scope was developed by the licensee to confirm that flood protection features credited in the CLB were acceptable and capable of performing their credited flood protection functions. Those passive features generally reported to have been inspected included: walls, roofs, and foundation mats of Category I structures at and below the 96-ft elevation. The inspection is also reported to have included all piping penetrations, electrical penetrations, miscellaneous openings, doors, equipment hatches, construction joints, and shake spaces associated with the walls, roof, and foundation mats. Visual inspections of the site topography, site drainage pathways, berms, ditches, culverts, and creeks were also conducted by the licensee.

The licensee noted that flood protection features at the RBS site do not include any temporary or active features that would require the implementation of a procedure for the performance of those manual/operator actions; hence, no "Reasonable Simulation" of manual actions was reported to have been performed. However, the licensee reported that there is a Preventive Maintenance (PM) program for the RBS site that requires the inspection of all designated flood protection doors. As part of the walkdowns, the licensee reported that the inspection interval of

⁹ ADAMS Accession No. ML12167A245.

¹⁰ ADAMS Accession No. ML12173A215.

the flood protection doors and inspection requirements detailed in the PM for each door were reviewed. Based on this review, some flood protection doors were observed to have inactive or retired PMs. All doors with retired PMs were entered into the RBS CAP for evaluation. The current conditions of the doors were evaluated during the inspection and found to be acceptable and pose no operability issues.

The licensee used acceptance criteria consistent with the intent of NEI 12-07. Items that did not meet the NEI 12-07 acceptance criteria were documented in the RBS CAP.

3.6.2 Licensee Evaluation of Flood Protection Effectiveness, Key Findings, and Identified Deficiencies

The licensee performed an evaluation of the overall effectiveness of the RBS's flood protection features. As a result of its walkdown inspections, flood protection mitigation measures were found to be acceptable, not degraded, and capable of performing their intended design function as credited in the CLB. There are no operator actions are credited for external flood protection for the RBS site.

NEI 12-07 defines a deficiency as follows: "a deficiency exists when a flood protection feature is unable to perform its intended function when subject to a design basis flooding hazard." The licensee did report that there were some observed conditions of features at the RBS site that did not meet the NEI 12-07 acceptance criteria. These conditions were entered into the site's CAP; however, the licensee reported that none of the reported observations were determined to be deficiencies as defined in NEI 12-07. Following an operability determination, the licensee concluded that the features could perform their intended flood protection function when subject to its design basis flooding hazard. However, as a proactive measure, the licensee reported that work orders were created as necessary to repair the conditions that it identified that did not meet the NEI 12-07 acceptance criteria.

NEI 12-07 specifies that licensees identify observations in the CAP that were not yet dispositioned at the time the walkdown report was submitted. Since the CAP has determined that there are no deficiencies, the licensee reported that there are no planned actions pending related to deficiencies.

3.6.3 Flood Protection and Mitigation Enhancements

The licensee did not identify any recently implemented or planned enhancements to the RBS site that are intended to improve or increase flood protection and/or mitigation in the walkdown report.

3.6.4 Planned or Newly Installed Features

The licensee did not determine that changes were necessary by the flood walkdowns.

3.6.5 Deficiencies Noted and Actions Taken or Planned to Address

No deficiencies were noted by the licensee that call for actions to be taken or planned to further enhance flood protection at the RBS site.

3.6.6 Staff Analysis of Walkdowns

The NRC staff reviewed the licensee walkdown report dated November 27, 2012. As part of the walkdown effort, the licensee evaluated the capability of flood protection features by conducting a series of visual inspections. Those inspections confirmed that credited design features were in-place, available, and capable of performing their intended flood protection or mitigation functions. The site has no temporary barriers and other manual actions that require operator action in the event of a flood threat; thus, the licensee did not perform a "Reasonable Simulation." No deficiencies were identified. No changes or enhancements to flood protection or mitigation features were identified as a result of the walkdowns. During the walkdowns, no corrective actions were identified.

Based on the NRC staff's review, the licensee appears to have provided results of the walkdown and described any other planned or newly installed flood protection systems or flood mitigation measures as requested in the 50.54(f) letter and consistent with the walkdown guidance. Based on the information provided in the licensee's submittals, the NRC staff concludes that the licensee's implementation of the walkdown process meets the intent of the walkdown guidance.

3.6.7 Available Physical Margin

The NRC staff issued an RAI to the licensee regarding the APM dated December 23, 2013. The licensee responded with a letter dated January 27, 2014. The licensee has reviewed its APM determination process, and entered any unknown APMs into the CAP. The staff reviewed the response, and concluded that the licensee met the intent of the APM determination per NEI 12-07.

Based on the NRC staff's review, the licensee appears to have documented the information requested for any cliff-edge effects, as requested in the 50.54(f) letter and consistent with the walkdown guidance. Further, the staff reviewed the response, and concludes that the licensee met the intent of the APM determination per NEI 12-07.

3.7 NRC Oversight

3.7.1 Independent Verification by Resident Inspectors

On June 27, 2012, the NRC issued Temporary Instruction (TI) 2515/187, "Inspection of Near-Term Task Force Recommendation 2.3 Flooding Walkdowns."¹¹ In accordance with the TI, NRC inspectors independently verified that the RBS licensee implemented the flooding walkdowns consistent with the intent of the walkdown guidance. Additionally, the inspectors independently performed walkdowns of a sample of flood protection features. The inspection report dated May 8, 2013,¹² as part of an NRC integrated inspection, documents the results of this inspection. No findings of significance were identified.

¹¹ ADAMS Accession No. ML12129A108.

¹² ADAMS Accession No. ML13128A427.

4.0 SSCS NOT WALKED DOWN

The licensee reported no restricted access features; only inaccessible features were identified.

4.1 Restricted Access

The licensee reported that there were no features or areas of the RBS physical plant for which there was restricted access as defined by NEI 12-07.

4.2 Inaccessible Features

The licensee reported that there were four locations/areas of the RBS physical plant were not inspected because of physical inaccessibility. They included the following:

- Portions of the east wall of the Diesel Generator Building and associated attributes (pipe penetrations). The licensee reported that rooms housing the diesel tanks are filled with sand.
- Foundation mat and Standby Cooling Tower walls. Following a review of design drawings, the licensee reported that these features are submerged beneath the water cells.
- Reactor Building walls and foundation mat. Following a review of design drawings, the licensee reported that these features are located beneath the suppression pool or within the drywell.

The licensee provided a basis for assurance that inaccessible features are available and will perform their credited flood protection functions. The licensee reported that inspection of accessible areas adjacent to these features revealed that they were in good condition and displayed no adverse condition that might call into question the functionality of the feature in question. The licensee also reported it relied on engineering design documents for the physical plant to aid in its review determinations, including the identification of expansion and construction joints containing seals. Based on these factors, the licensee stated that there is assurance that the inaccessible features are available and functional.

5.0 CONCLUSION

The NRC staff concludes that the licensee's implementation of flooding walkdown methodology meets the intent of the walkdown guidance. The staff concludes that the licensee, through the implementation of the walkdown guidance activities and, in accordance with plant processes and procedures, verified the plant configuration with the current flooding licensing basis; addressed degraded, nonconforming, or unanalyzed flooding conditions; and verified the adequacy of monitoring and maintenance programs for protective features. Furthermore, the licensee's walkdown results, which were verified by the staff's inspection, identified no immediate safety concerns. The NRC staff reviewed the information provided and determined that sufficient information was provided to be responsive to Enclosure 4 of the 50.54(f) letter.

If you have any questions, please contact me at (301) 415-1445 or by e-mail at Alan.Wang@nrc.gov.

Sincerely,

/RA/

Alan Wang, Project Manager
 Plant Licensing IV-2 and Decommissioning
 Transition Branch
 Division of Operating Reactor Licensing
 Office of Nuclear Reactor Regulation

Docket No. 50-458

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 Staff Assessment of Flooding
 Walkdown Report

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